Remarks

Support for the above-requested amendments to claim 1 is found at least at paragraphs [0001], [0008], and [0011] and in Table 1. Claim 21 has been canceled without prejudice. Claims 9, 16-20, and 22-26 were canceled in previous Amendments. No question of new matter arises and entry of the above-requested amendments is respectfully requested.

Claims 1-8 and 10-15 are before the Examiner for consideration.

Rejection of Claims 1-8 and 10-15 under 35 U.S.C. §103(a)

Claims 1-8 and 10-15 have been rejected under 35 U.S.C. §103(a) as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent Publication No. 2005/0027040 to Nelson, *et al.* ("Nelson"). The Examiner asserts that Grinshpun teaches a method of manufacturing a rigid foam that consists essentially of (1) incorporating fillers and at least one nucleating agent and reinforcing materials such as graphite, conductive carbon black, and nanofillers into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure to allow the polymer melt to expand and foam, and (4) cooling the foamed product. It is asserted that the foam has a cell size that ranges from 25-7000 microns. The Examiner admits that Grinshpun does not explicitly teach that the calcium carbonate employed either as a nucleating agent or as a filler/reinforcing material has a particle size in at least one dimension of less than 100 angstroms.

In this regard, Nelson is cited for assertedly disclosing a method where inorganic additives such as nanoparticles of calcium carbonate are combined with a resin to form nanocomposite additives for extrusion processes. It is also asserted that the calcium carbonate used to form the nanocomposite has a particle size as low as about 2 nm. Thus, the Examiner concludes that it would have been obvious to one of skill in the art to use the calcium carbonate nanocomposites taught by Nelson in the method of Grinshpun to improve the blendability of the additives and to improve the mechanical and thermal properties of the article to be produced.

Applicants' Response

In response to this rejection, Applicants respectfully direct the Examiner's attention to independent claim 1 and submit that claim 1 defines a method of manufacturing a rigid foam

board that is not taught or suggested within Grinshpun, either alone or in combination with Nelson. Additionally, Applicants respectfully submit that neither Grinshpun nor Nelson teaches or suggests the combination of features recited in amended claim 1.

Grinshpun teaches a foamable composition that is extruded through a die having a plurality of orifices, each of which forms a hollow extrudate. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24). The hollow extrudate is converted into foamed hollow extrudate strands at a temperature that promotes bubble stability. (*See, e.g.*, page 2, lines 22-24 and page 20, lines 26-28). The final step includes permitting the hollow strands to contact and adhere to each other to form a hollow, multistrand polymer foam extrudate. (*See, e.g.*, page 2, lines 25-28 and page 20, lines 28-31). The hollow tubes are joined together in a coalescing step. (*See, e.g.*, page 20, lines 28-31).

In the Examiner's Answer, it is asserted that Grinshpun teaches a rigid foam board (*See, e.g.*, page 3, paragraph (9) of the Examiner's Answer dated August 4, 2009). Applicants submit that claim 1 has been amended to specifically recite that the foam board has a solid foam structure. As taught at least by Table 1 on page 10 of the application, the foam is extruded by a flat face die/shaper plate or a flat slot die. As explained in the attached Declaration under 37 C.F.R. §1.131, and as one of skill in the art would appreciate, such dies would form solid or otherwise contiguous foam structure throughout the foam board. (*See* paragraph 3 of the Declaration under 37 C.F.R. §1.131 by Rodger Lightle attached hereto). The disclosed extruder/single slot die combinations extrude a solid, contiguous sheet of foamed material. (*Id.*). It is respectfully submitted that the dies disclosed in Table 1 on page 10 of the application simply do *not* create tubular structures, such as is disclosed in Grinshpun, in the formation of the claimed rigid, solid foam board.

The dies in Grinshpun are multi-orifice dies that are used to form foamed structures that contain hollow tubes. (*See* paragraph 4 of the Declaration under 37 C.F.R. §1.131 by Rodger Lightle). The dies of Grinshpun simply do not produce a solid, contiguous foam board as is described in the present application. (*Id.*). It is therefore respectfully submitted that in the present invention, the foam board of claim 1 has a rigid, solid (*e.g.*, contiguous) foam structure, which is vastly different from the foamed structure containing hollow tubes (*e.*g., hollow extrudates) taught by Grinshpun. Indeed, the foams of the present invention and the foams of Grinshpun are two entirely different foam structures. (*Id.*).

Moreover, it is respectfully submitted that the foam "sheet" formed by the coalesced hollow tubes of Grinshpun cannot be a rigid structure, at least partially due to the lack of material within the foam tubes. Indeed, Grinshpun expressly teaches that the hollow foam strands are flexible and compressible. (*See, e.g.*, page 10, lines 17-20). Accordingly, the foam structure of Grinshpun cannot be a rigid foam board as required by independent claim 1.

Applicants further respectfully submit that there is no requirement for an explicit statement within the specification that the foam board have a solid foam structure. As taught in MPEP §2163, there is no *in haec verba* requirement; newly added claim limitations must be supported in the specification through express, implicit, or inherent disclosure. (*See Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 6, August 2007). As taught at least by Table 1 on page 10 of the application, the foam is extruded by a flat face die/shaper plate or a flat slot die. As discussed above and disclosed in the attached Declaration, such dies would form solid foam structures and not hollow tubes as are extruded by the multi-orifice die of Grinshpun. (*See, e.g.*, page 2, lines 19-21 and page 20, lines 22-24 of Grinshpun and paragraphs 3 and 4 of the Declaration under 37 C.F.R. §1.131 of Rodger Lightle). Applicants submit that the application, read as a whole, and taking into consideration the Declaration under 37 C.F.R. §1.131 submitted herewith, teaches, if at least inherently, a foam board having a solid (*e.g.*, contiguous) foam structure.

It is respectfully submitted that in the present invention, the foam board of claim 1 has a solid, contiguous foam structure, unlike the hollow tubular structures forming the foamed structures of Grinshpun. (*See, e.g.*, the Declaration under 37 C.F.R. §1.131 by Rodger Lightle, attached hereto for the Examiner's convenience). In fact, nowhere in Grinshpun is there any teaching or suggestion of extruding a polymer melt under a second pressure and at a second temperature where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam board having a solid (contiguous) foam structure as is required in claim 1. Indeed, the extrusion die in Grinshpun is specifically chosen so that it forms a structure having hollow tubes, not a foam board having a solid foam structure. Applicants respectfully submit that there is simply no teaching or suggestion within Grinshpun of extruding a foam board having a solid foam structure as claimed in claim 1. Nelson is silent with respect to any teaching or suggestion of extruding a foam board, and as such, cannot make up for the deficiencies of Grinshpun. Accordingly, it is

respectfully submitted that the combination of the teachings of Grinshpun and Nelson would not result in the inventive method of claim 1.

In addition, Applicants submit that Grinshpun teaches away from a method of manufacturing a rigid foam board that includes the step of extruding a polymer melt under a second pressure and at a second temperature that allow the polymer melt to expand and form a foam board having a solid foam structure. As discussed above, Grinshpun specifically teaches the extrusion of a hollow extrudate. (*See, e.g.*, page 2, lines 22-24 and page 20, lines 26-28 and paragraph 4 of the Declaration under 37 C.F.R. §1.131). There is simply no teaching or suggestion within Grinshpun of extruding a foam board having a solid foam structure. Indeed, Applicants respectfully submit that one of skill in the art reading Grinshpun would be led away from extruding a polymer melt under a second pressure and at a second temperature which permits the polymer melt to expand and form a foam board having a solid foam structure as is claimed in claim 1. As discussed above, Nelson cannot make up for the deficiencies of Grinshpun. As such, it is respectfully submitted that claim 1 is non-obvious and patentable for this additional reason.

Further, Applicants respectfully submit that there is no motivation for one of skill in the art to arrive at a method of manufacturing a rigid foam board having a solid foam structure based on the teachings of Grinshpun and Nelson. To establish a *prima facie* case of obviousness, there must be some motivation, either within the reference or in the knowledge of those of skill in the art, to modify the reference or combine the references' teachings, there must be a reasonable expectation of success, and the prior art references must meet all of the claim limitations. (*See, e.g.*, *Manual of Patent Examining Procedure*, Patent Publishing, LLC, Eighth Ed., Rev. 7, August 2008, §2143 citing *KSR International Co. v. Teleflex Inc.*, 550 U.S. 398, 82 USPQ2d 1385 (2007)).

It is respectfully submitted that one of ordinary skill in the art would have no motivation to arrive at method for manufacturing a rigid foam board that has a solid foam structure based on the teachings of Grinshpun and Nelson because Grinshpun specifically teaches the extrusion of hollow extrudates. Indeed, Applicants submit that Grinshpun teaches away from the method recited in claim 1. Without some teaching or suggestion, there can be no motivation, and without motivation, there can be no *prima facie* case of obviousness.

With respect to claims 2-8 and 10-15, Applicants submit that because independent claim 1 is not taught or suggested by Grinshpun or Nelson and claims 2-8 and 10-15 are

dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-8 and 10-15 are also not taught or suggested by Grinshpun and/or Nelson.

In light of the above, Applicants submit that claims 1-8 and 10-15 are not obvious over Grinshpun in view of Nelson and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claims 1-8, 10-12, 14 and 15 under 35 U.S.C. §103(a)

The Examiner has rejected claims 1-8, 10-12, 14, and 15 as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of U.S. Patent No. 6,589,6456 to Morgenstern ("Morgenstern"). The Examiner asserts that Grinshpun teaches a method of manufacturing a rigid foam that consists essentially of (1) incorporating fillers and at least one nucleating agent and reinforcing materials such as graphite, conductive carbon black, and nanofillers into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure to allow the polymer melt to expand and foam, and (4) cooling the foamed product. It is asserted that the foam has a cell size that ranges from 25-7000 microns. The Examiner admits that Grinshpun does not explicitly teach that the calcium carbonate employed either as a nucleating agent or as a filler/reinforcing material has a particle size in at least one dimension of less than 100 angstroms. In this regard, the Examiner asserts that Morgenstern discloses that calcium carbonate having a particle size as low as 50 angstroms may be employed as an inorganic filler/nucleating agent in foam applications. The Examiner concludes that it would have been obvious to one of skill in the art to employ the calcium carbonate disclosed by Morgenstern for the purpose of employing an art recognized suitable and conventional nucleating agent to produce a foam product.

Applicants' Response

In response to this rejection, Applicants respectfully direct the Examiner's attention to independent claim 1 and to the arguments set forth above with respect to the rejection of claims 1-8 and 10-15 under 35 U.S.C. §103(a) over Grinshpun in view of Nelson and submit that claim 1 defines a method for manufacturing a rigid foam board that is not taught or suggested within Grinshpun and Nelson. In addition, Applicants submit that the teachings of Morgenstern do not add to the Examiner's rejection so as to make claim 1 unpatentable. Applicants respectfully submit that even with the addition of the teachings of Morgenstern,

Grinshpun (with or without Nelson) still does not teach or suggest a method that consists essentially of (1) incorporating nano-particles selected from calcium carbonate, intercalated graphites and expanded graphites into a polymer melt where the nano-particles have a particle size in at least one dimension less than 100 angstroms and the polymer melt includes an alkenyl aromatic polymer material, (2) incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature, where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam board having a solid foam structure, and (4) cooling the foam board, where the foam board has an average cell size between 60 μm and 120 μm and a cell size distribution as claimed in amended claim 1. Indeed, Morgenstern is silent with respect to any teaching or suggestion of extruding a foam board. As such, it is submitted that the combination of Grinshpun and Morgenstern does not teach or suggest Applicants' invention as recited in claim 1.

With respect to claims 2-8, 10-12, 14, and 15, Applicants submit that because independent claim 1 is not taught or suggested by Grinshpun or Morgenstern and claims 2-8, 10-12, 14, and 15 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-8, 10-12, 14, and 15 are also not taught or suggested by Grinshpun and/or Morgenstern.

In light of the above, Applicants submit that claims 1-8, 10-12, 14, and 15 are not obvious over Grinshpun in view of Morgenstern and respectfully request that this rejection be reconsidered and withdrawn.

Rejection of Claims 1-8, 10-12, 14-15, and 21 under 35 U.S.C. §103(a)

The Examiner has rejected claims 1-8, 10-12, 14-15, and 21 as being unpatentable over WO 2001/39954 to Grinshpun, *et al.* ("Grinshpun") in view of WO 2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan"). The Examiner asserts that Grinshpun teaches a method of manufacturing a rigid foam that includes (1) incorporating fillers and at least one nucleating agent and reinforcing materials such as graphite, conductive carbon black and nanofillers into a polymer, (2) incorporating a blowing agent into the melt under a first temperature and a first pressure, (3) extruding the polymer melt under a second temperature and second pressure to allow the polymer melt to expand and foam, and (4) cooling the foamed product. It is asserted that the foam has a cell size that

ranges from 25-7000 microns. Grinshpun does not specify the shape or particle size of the fillers and reinforcing materials.

In this regard, Chen is cited for assertedly disclosing calcium carbonate whiskers/needles with a particle size as low as 10 nm (100 angstroms). In addition, the Examiner asserts that Tan teaches the use of nanofibers and nanopowders in the production of nanocomposite foams. The Examiner concludes that it would have been obvious to one of skill in the art to use a nanofiller, such as acicular calcium carbonate, with a particle size less than 100 angstroms in the method of Grinshpun as taught by Chen and Tan to produce a lightweight material with superior mechanical properties.

Applicants' Response

Initially, Applicants submit that claim 21 has been canceled without prejudice, thereby rendering the rejection of claim 21 moot.

In response to the rejection of claims 1-8, 10-12, and 14-15, Applicants respectfully direct the Examiner's attention to independent claim 1 and to the arguments set forth above with respect to the rejection of claims 1-8 and 10-15 under 35 U.S.C. §103(a) over Grinshpun in view of Nelson and submit that claim 1 defines a method for manufacturing a rigid foam board that is not taught or suggested within Grinshpun and Nelson. In addition, Applicants submit that the teachings of Chen and Tan do not add to the Examiner's rejection so as to make claim 1 unpatentable. Even with the addition of the teachings of Chen and Tan, Grinshpun (and Nelson) still do not teach or suggest a method that consists essentially of (1) incorporating nano-particles selected from calcium carbonate, intercalated graphites and expanded graphites into a polymer melt where the nano-particles have a particle size in at least one dimension less than 100 angstroms and the polymer melt includes an alkenyl aromatic polymer material, (2) incorporating a blowing agent into the polymer melt under a first pressure and at a first temperature, (3) extruding the polymer melt under a second pressure and at a second temperature, where the second pressure and second temperature are sufficient to allow the polymer melt to expand and form a foam board having a solid foam structure, and (4) cooling the foam board, where the foam board has an average cell size between 60 μm and 120 μm and a cell size distribution as claimed in amended claim 1. As discussed in detail above, Grinshpun clearly teaches a foam containing hollow tubular structures. Thus, regardless of the teachings of Chen and Tan, the foam produced would still not be the solid foam claimed in claim 1. As such, it is submitted that the combination of

Grinshpun, Chen, and Tan does not teach or suggest Applicants' invention as recited in claim 1.

With respect to dependent claims 2-8, 10-12, and 14-15, Applicants submit that because independent claim 1 is not taught or suggested by Grinshpun, Chen, and Tan and claims 2-8, 10-12, and 14-15 are dependent upon independent claim 1 and contain the same elements as claim 1, dependent claims 2-8, 10-12, and 14-15 are also not taught by Grinshpun, Chen, and/or Tan.

In view of the above, Applicants submit that claims that claims 1-8, 10-12, and 14-15 are not obvious over Grinshpun, Chen, and/or Tan and respectfully request that the Examiner reconsider and withdraw this rejection.

Rejection of Claim 21 under 35 U.S.C. §103(a)

The Examiner has rejected claim 21 as being unpatentable over WO 2001/40362 to Miller, *et al.* ("Miller") in view of WO 2003/055804 to Chen, *et al.* ("Chen") and U.S. Patent No. 7,160,929 to Tan ("Tan"). In particular, the Examiner asserts that Miller teaches the claimed process of producing an extruded rigid foam where a blowing agent is incorporated into the polymer melt at a first pressure and temperature, extruding the polymer melt under a second pressure and temperature to form a foam, and intrinsically cooling the foam to form a product with a cell size within the claimed range. It is asserted that the preferred polymer melt includes an alkenyl aromatic polymer material. The Examiner admits that Miller does not disclose utilizing acicular calcium carbonate with a particle size in at least one dimension of less than 100 angstroms.

In this regard, Chen is cited for assertedly disclosing calcium carbonate whiskers/needles with a particle size as low as 10 nm (100 angstroms). In addition, the Examiner asserts that Tan teaches the use of nanofibers and nanopowders in the production of nanocomposite foams. The Examiner concludes that it would have been obvious to one of skill in the art to use a nanofiller, such as acicular calcium carbonate, with a particle size less than 100 angstroms in the method of Grinshpun as taught by Chen and Tan to produce a lightweight material with superior mechanical properties.

Applicants' Response

In response, Applicants submit that claim 21 has been canceled without prejudice, thereby rendering the rejection of this claim moot. Accordingly, Applicants respectfully request reconsideration and withdrawal of this rejection.

Conclusion

In light of the above, Applicants believe that this application is now in condition for allowance and therefore request favorable consideration.

If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

If necessary, the Commissioner is hereby authorized to charge payment or credit any overpayment to Deposit Account No. 50-0568 for any additional fees required under 37 C.F.R. § 1.16 or under 37 C.F.R. § 1.17; particularly, extension of time fees.

Respectfully submitted,

Date: __September 24, 2009

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